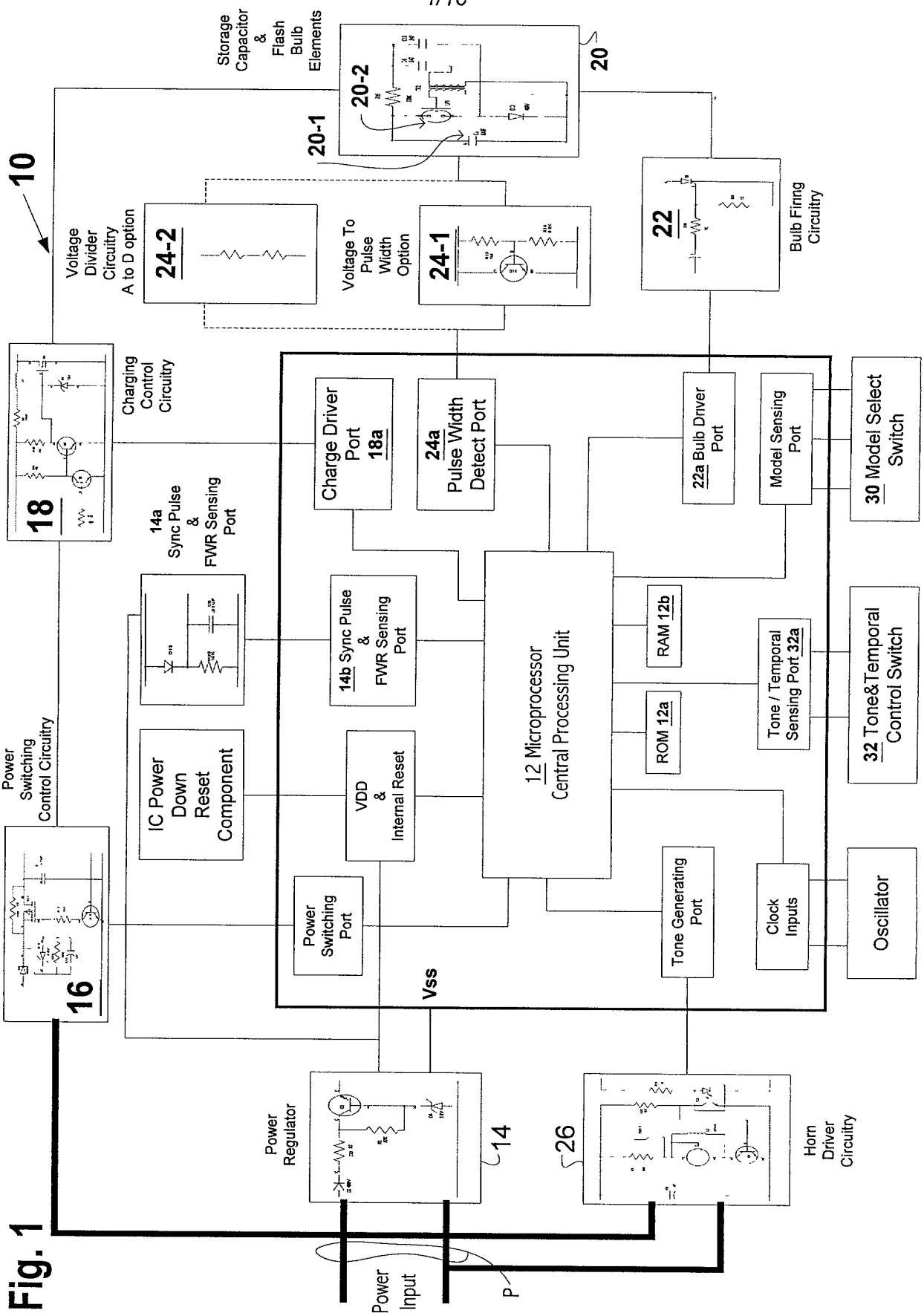

10
Storage Capacitor & Flash Bulb Elements
20
20-1
20-2
Voltage Divider Circuitry A to D option
24-2
Voltage To Pulse Width Option
24-1
22
Bulb Firing Circuitry
18
Charging Control Circuitry
Charge Driver Port 18a
24a Pulse Width Detect Port
22a Bulb Driver Port
Model Sensing Port
30 Model Select Switch
14a Sync Pulse & FWR Sensing Port
14b Sync Pulse & FWR Sensing Port
12 Microprocessor Central Processing Unit
RAM 12b
ROM 12a
Tone / Temporal Sensing Port 32a
32 Tone&Temporal Control Switch
Power Switching Control Circuitry
IC Power Down Reset Component
VDD & Internal Reset
Power Switching Port
Tone Generating Port
Clock Inputs
Oscillator
16
Vss
Power Regulator
14
26
Horn Driver Circuitry
Power Input
P

Fig. 1

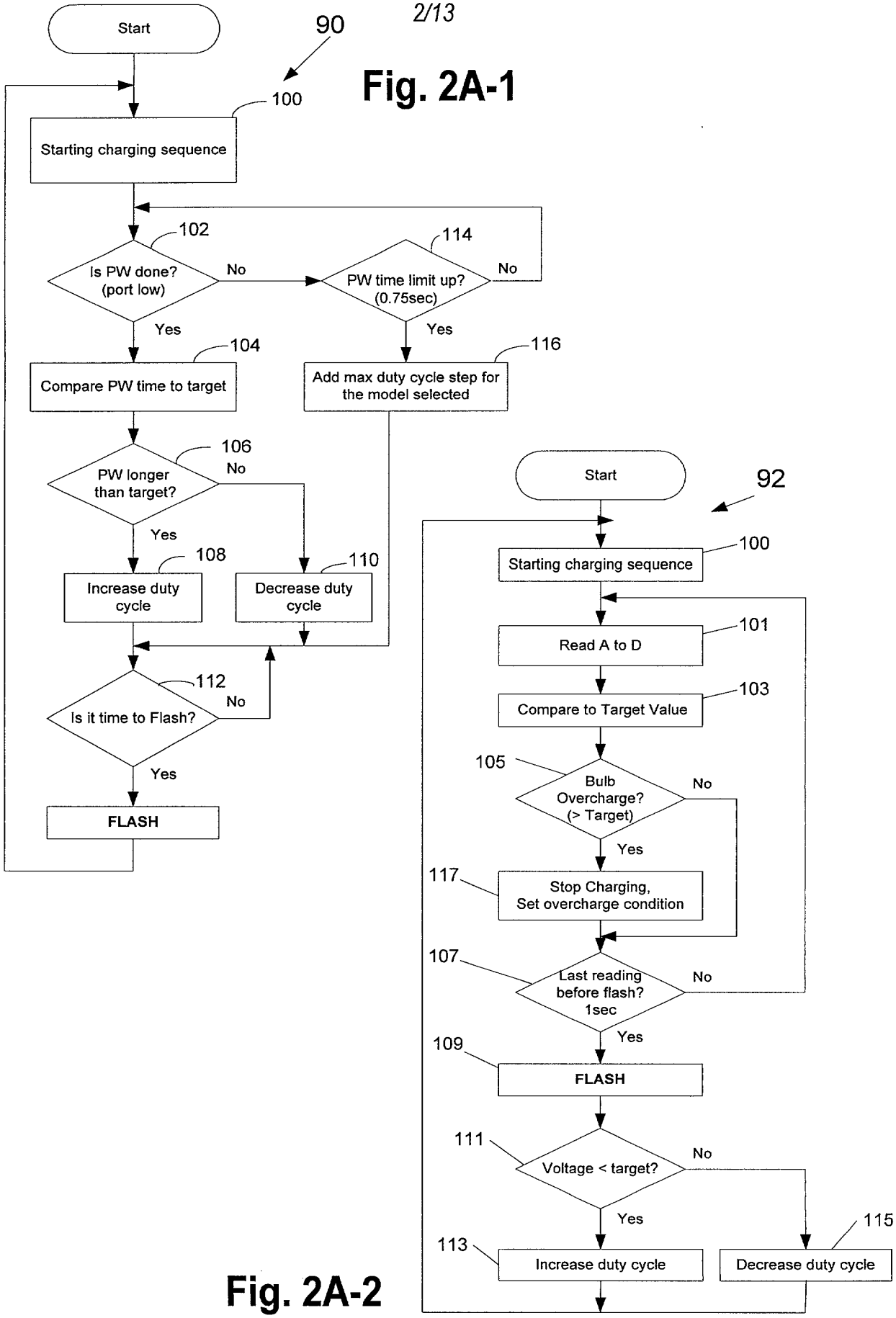


Fig. 2A-1

Fig. 2A-2

ESN89.USO1

EXPRESS MAIL LABEL NO.

Fig. 2B

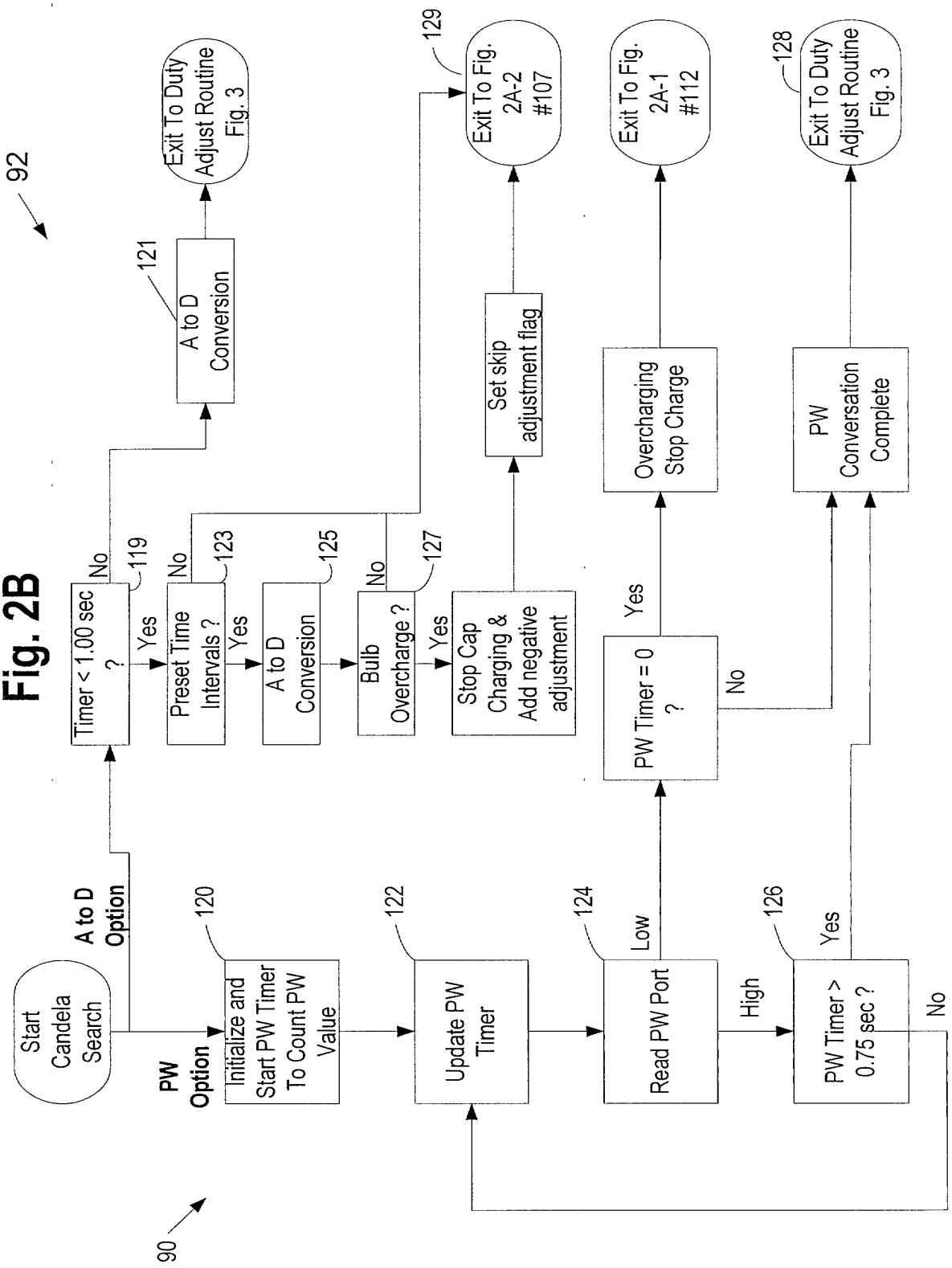


Fig. 3

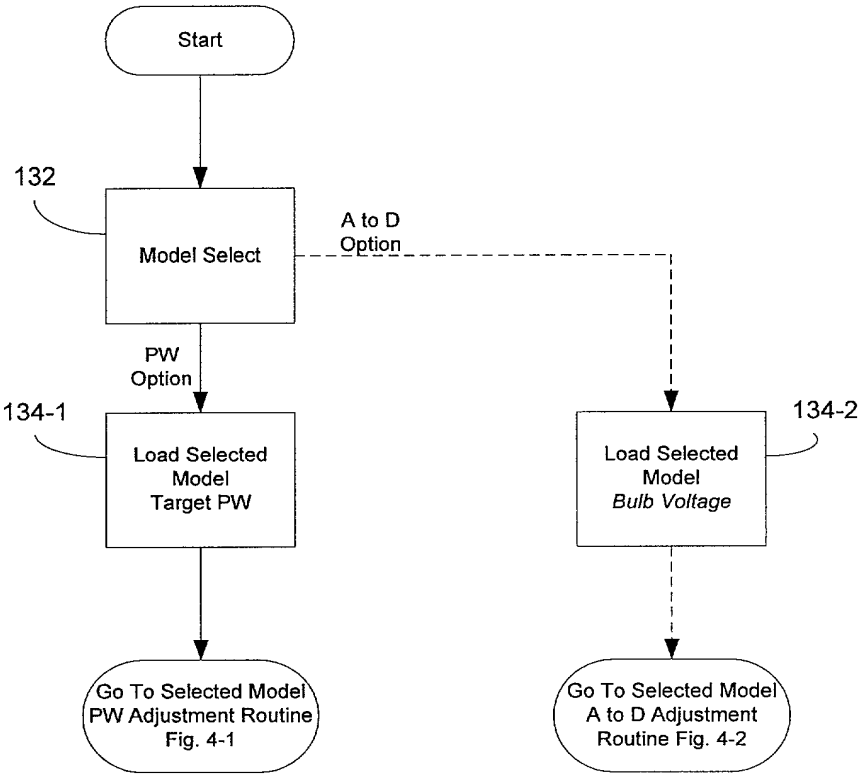


EXHIBIT 1004

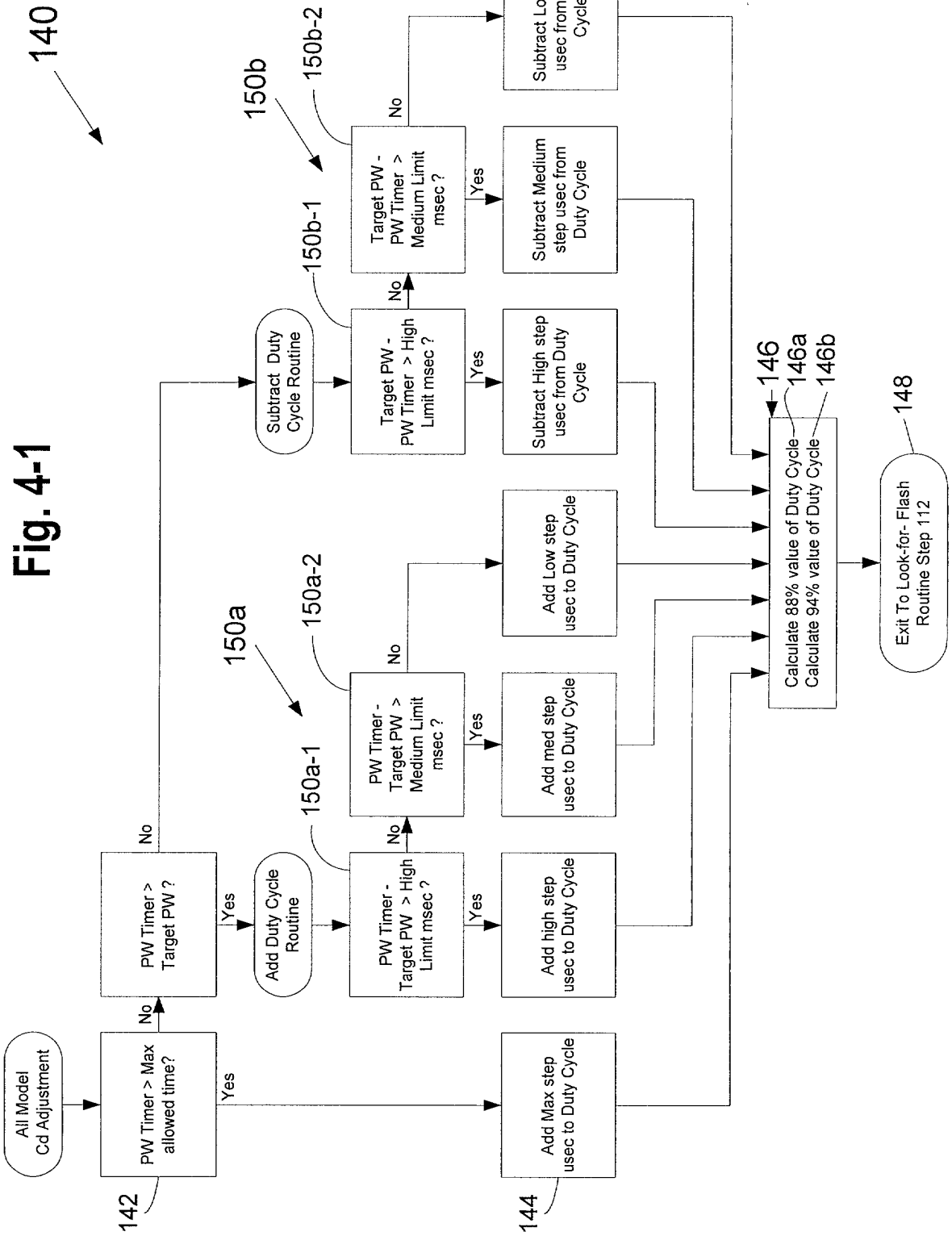
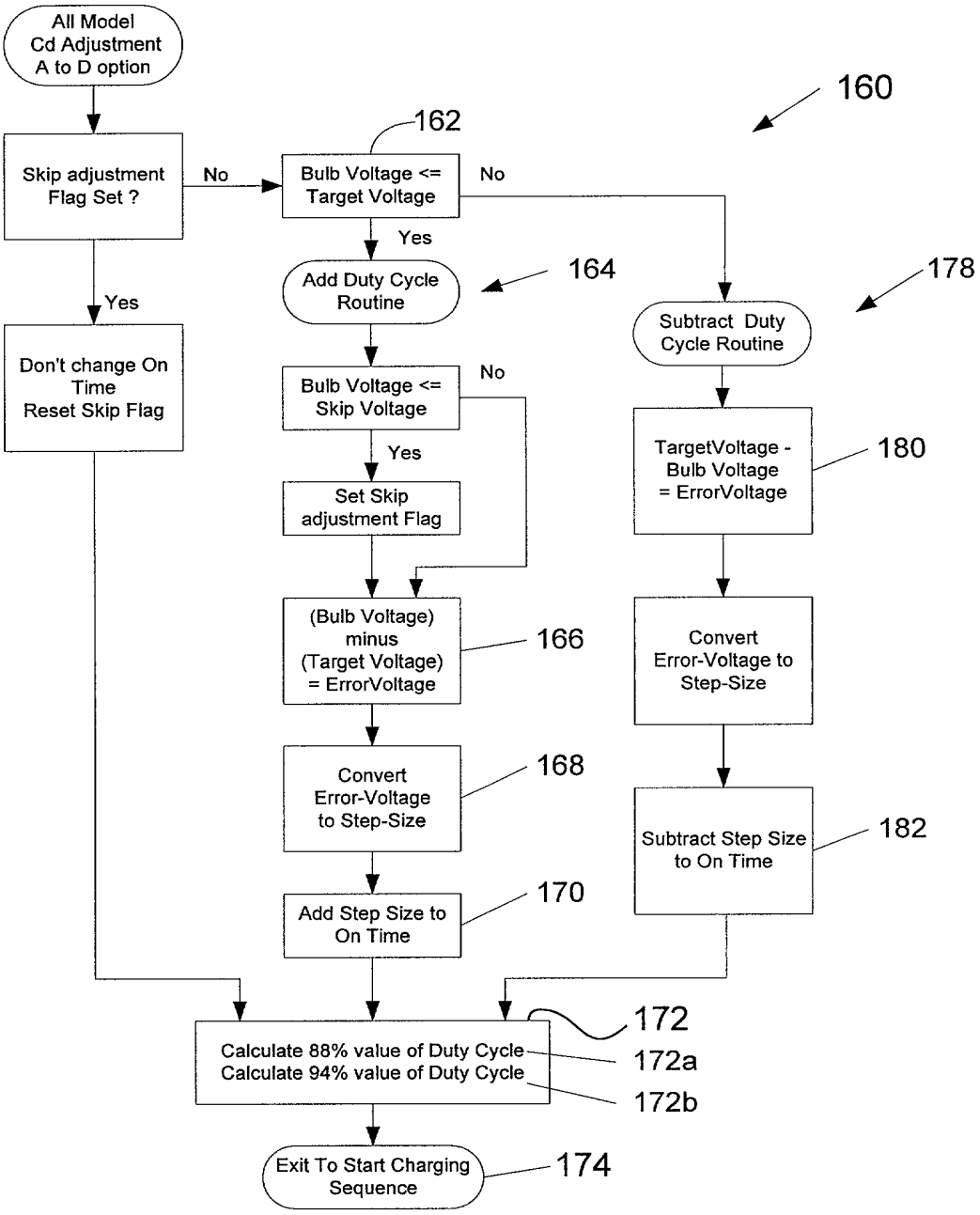

140
All Model Cd Adjustment
PW Timer > Max allowed time?
142
No
Yes
PW Timer > Target PW ?
No
Yes
Add Duty Cycle Routine
PW Timer - Target PW > High Limit msec ?
150a-1
No
Yes
Add high step usec to Duty Cycle
PW Timer - Target PW > Medium Limit msec ?
150a
150a-2
No
Yes
Add med step usec to Duty Cycle
Add Low step usec to Duty Cycle
Subtract Duty Cycle Routine
Target PW - PW Timer > High Limit msec ?
150b
150b-1
No
Yes
Subtract High step usec from Duty Cycle
Target PW - PW Timer > Medium Limit msec ?
150b-2
No
Yes
Subtract Medium step usec from Duty Cycle
Subtract Low step usec from Duty Cycle
Add Max step usec to Duty Cycle
144
146
146a
146b
Calculate 88% value of Duty Cycle
Calculate 94% value of Duty Cycle
148
Exit To Look-for- Flash Routine Step 112

Fig. 4-1

Fig. 4-2


All Model Cd Adjustment A to D option
Skip adjustment Flag Set ?
No
Yes
Don't change On Time Reset Skip Flag
Bulb Voltage <= Target Voltage
No
Yes
Add Duty Cycle Routine
Bulb Voltage <= Skip Voltage
No
Yes
Set Skip adjustment Flag
(Bulb Voltage) minus (Target Voltage) = ErrorVoltage
Convert Error-Voltage to Step-Size
Add Step Size to On Time
Subtract Duty Cycle Routine
TargetVoltage - Bulb Voltage = ErrorVoltage
Convert Error-Voltage to Step-Size
Subtract Step Size to On Time
Calculate 88% value of Duty Cycle
Calculate 94% value of Duty Cycle
Exit To Start Charging Sequence
160
162
164
166
168
170
172
172a
172b
174
178
180
182

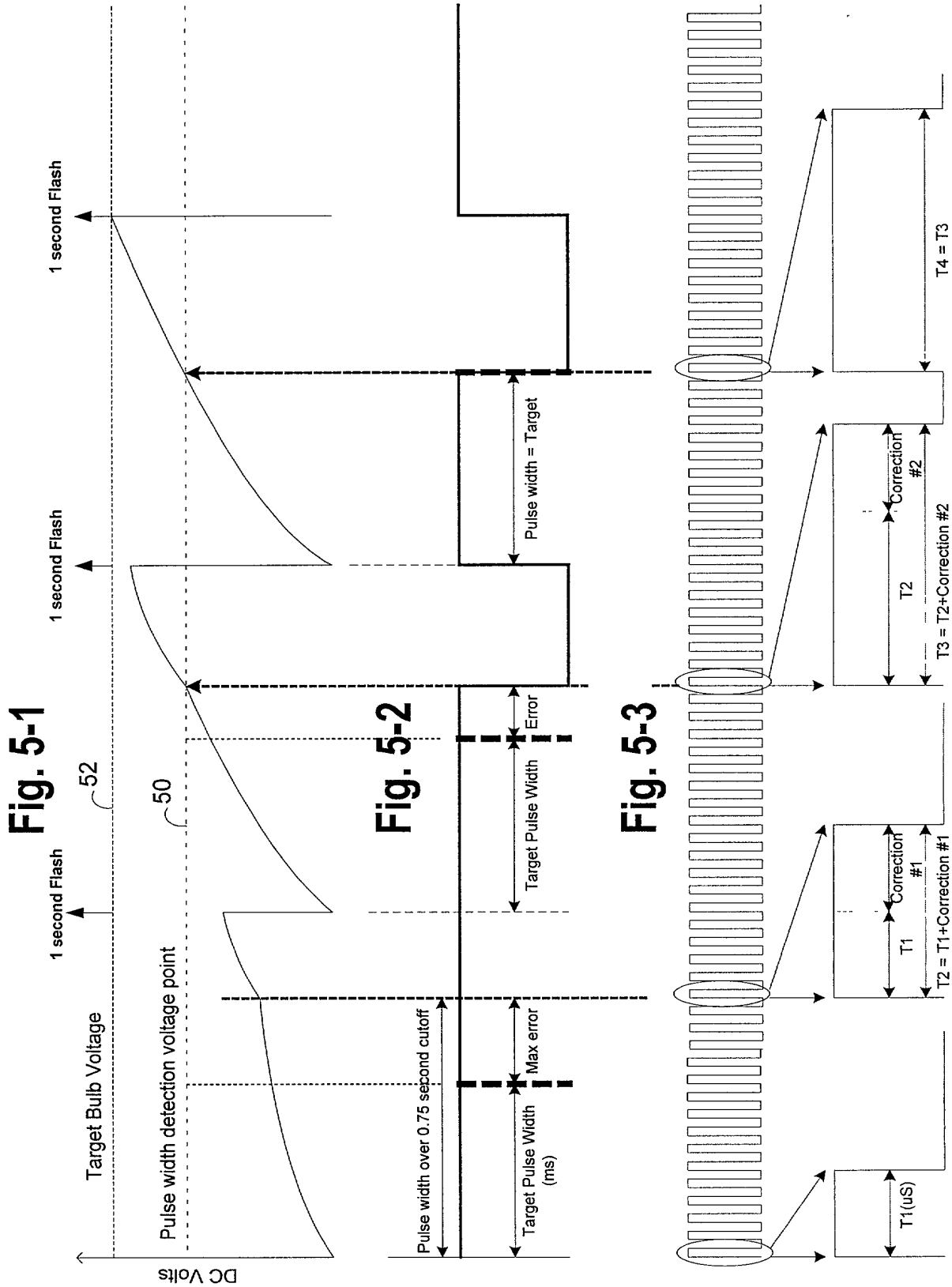


Fig. 5-1

Fig. 5-2

Fig. 5-3

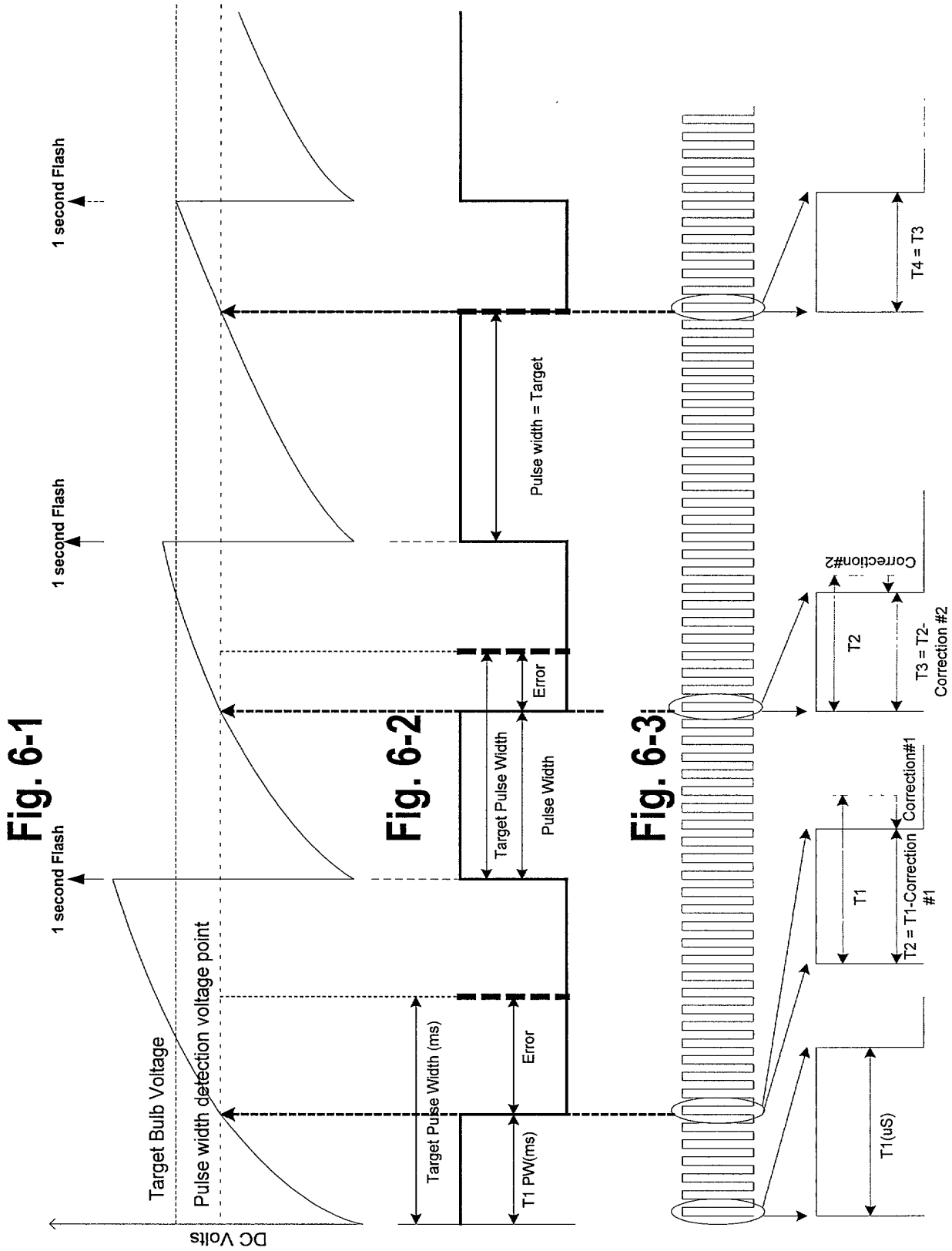


Fig. 6-1

Fig. 6-2

Fig. 6-3

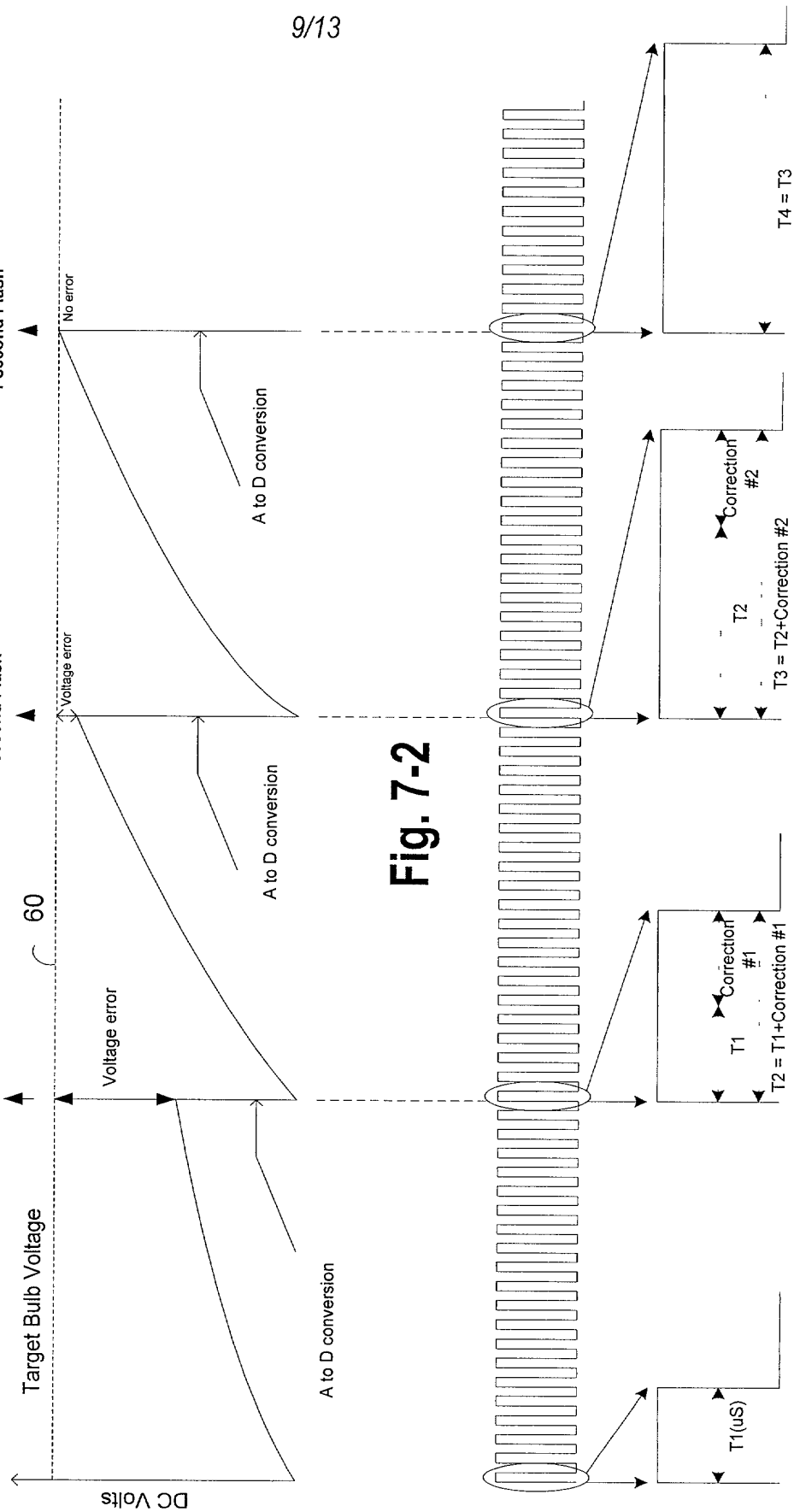

DC Volts
Target Bulb Voltage
1 second Flash
Voltage error
A to D conversion
1 second Flash
Voltage error
A to D conversion
1 second Flash
No error
A to D conversion
60
T1(uS)
T1
Correction #1
T2 = T1+Correction #1
T2
Correction #2
T3 = T2+Correction #2
T4 = T3

Fig. 7-1

Fig. 7-2

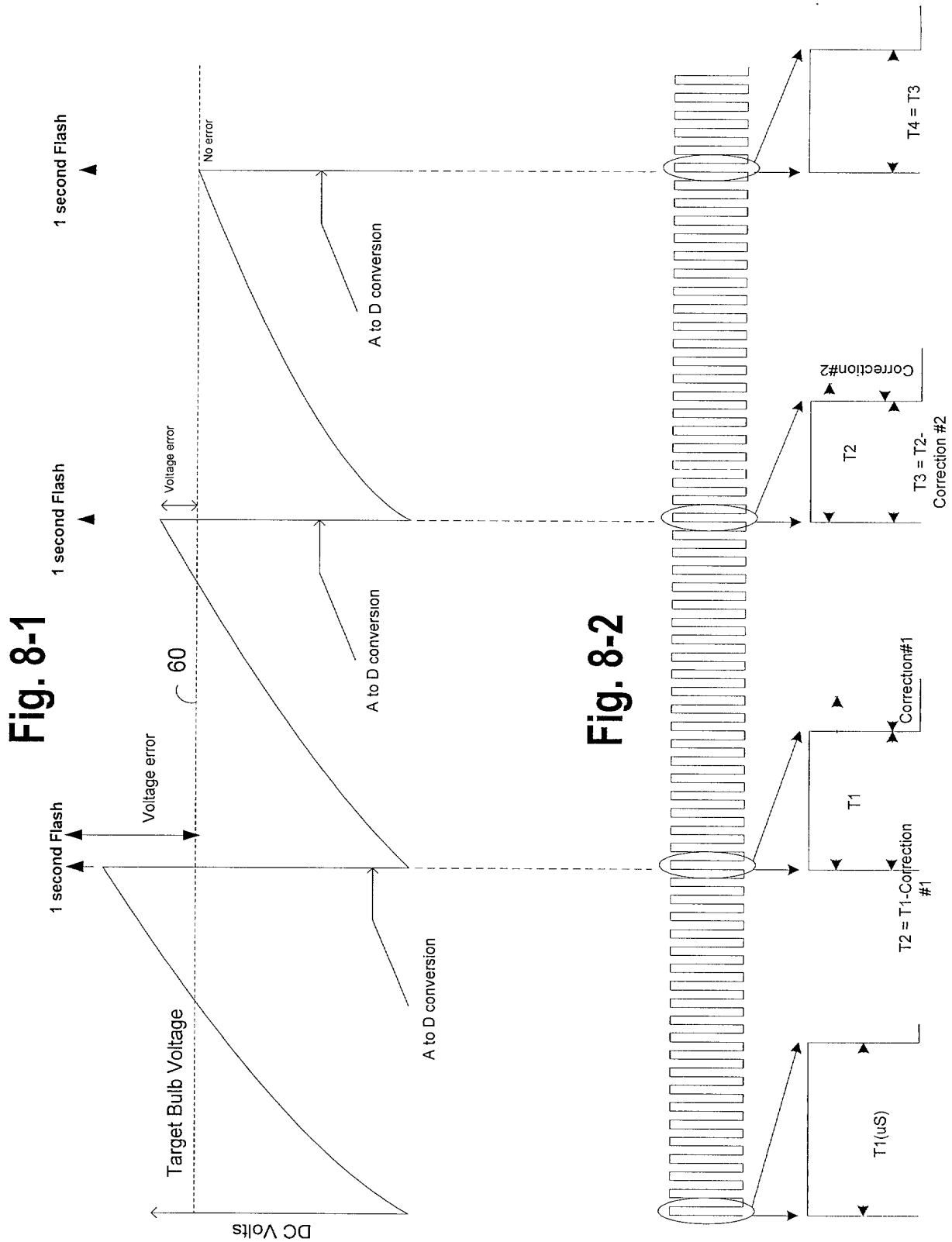

1 second Flash
1 second Flash
1 second Flash
Voltage error
Voltage error
No error
60
A to D conversion
A to D conversion
A to D conversion
Target Bulb Voltage
DC Volts
T1
T2
T3 = T2-Correction #2
T4 = T3
T1(uS)
T2 = T1-Correction #1
Correction#1
Correction#2

Fig. 8-1

Fig. 8-2

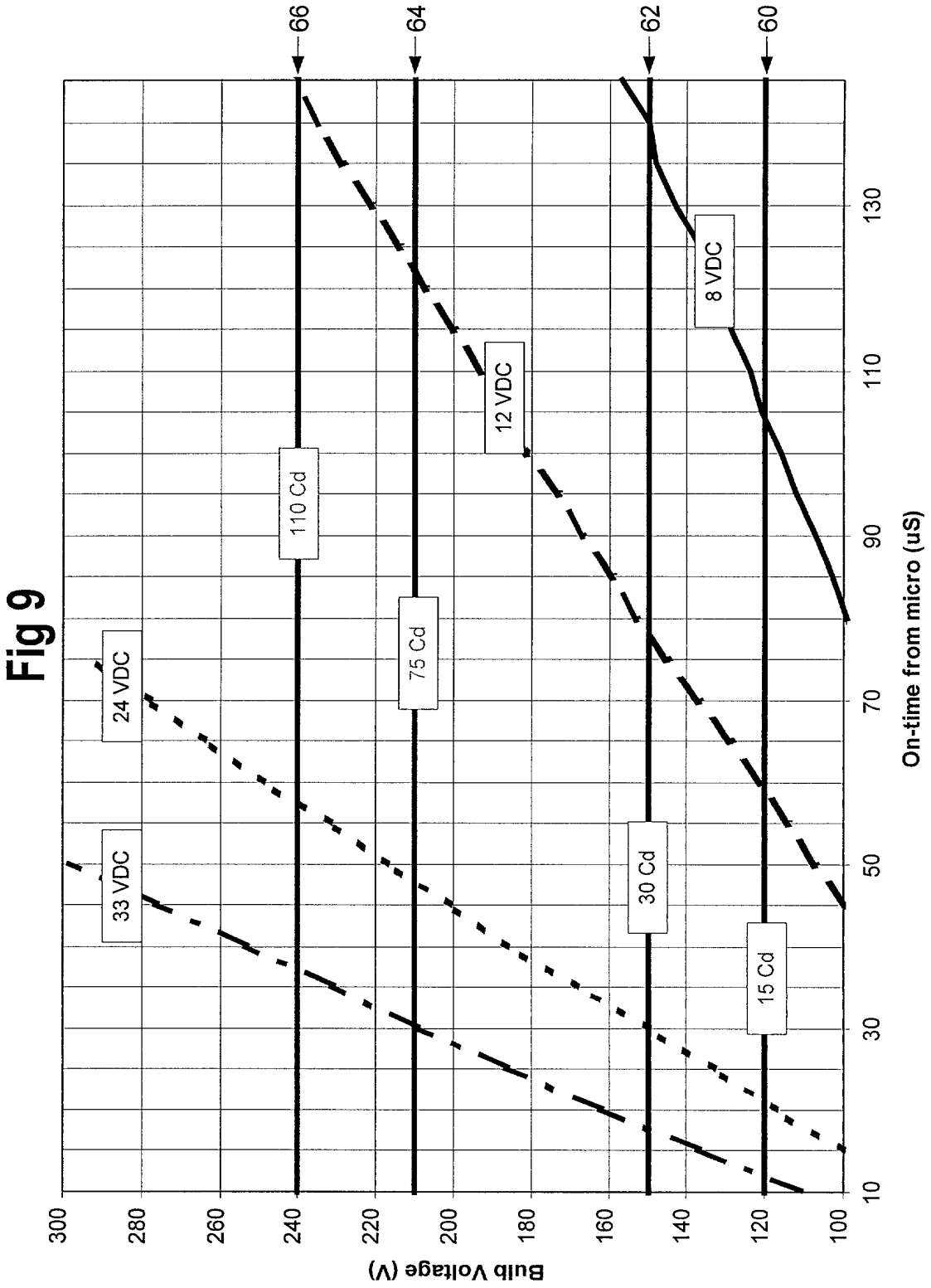

66
64
62
60
110 Cd
75 Cd
30 Cd
15 Cd
24 VDC
33 VDC
12 VDC
8 VDC
Bulb Voltage (V)
On-time from micro (uS)
300
280
260
240
220
200
180
160
140
120
100
10
30
50
70
90
110
130

Fig 9

Fig. 10

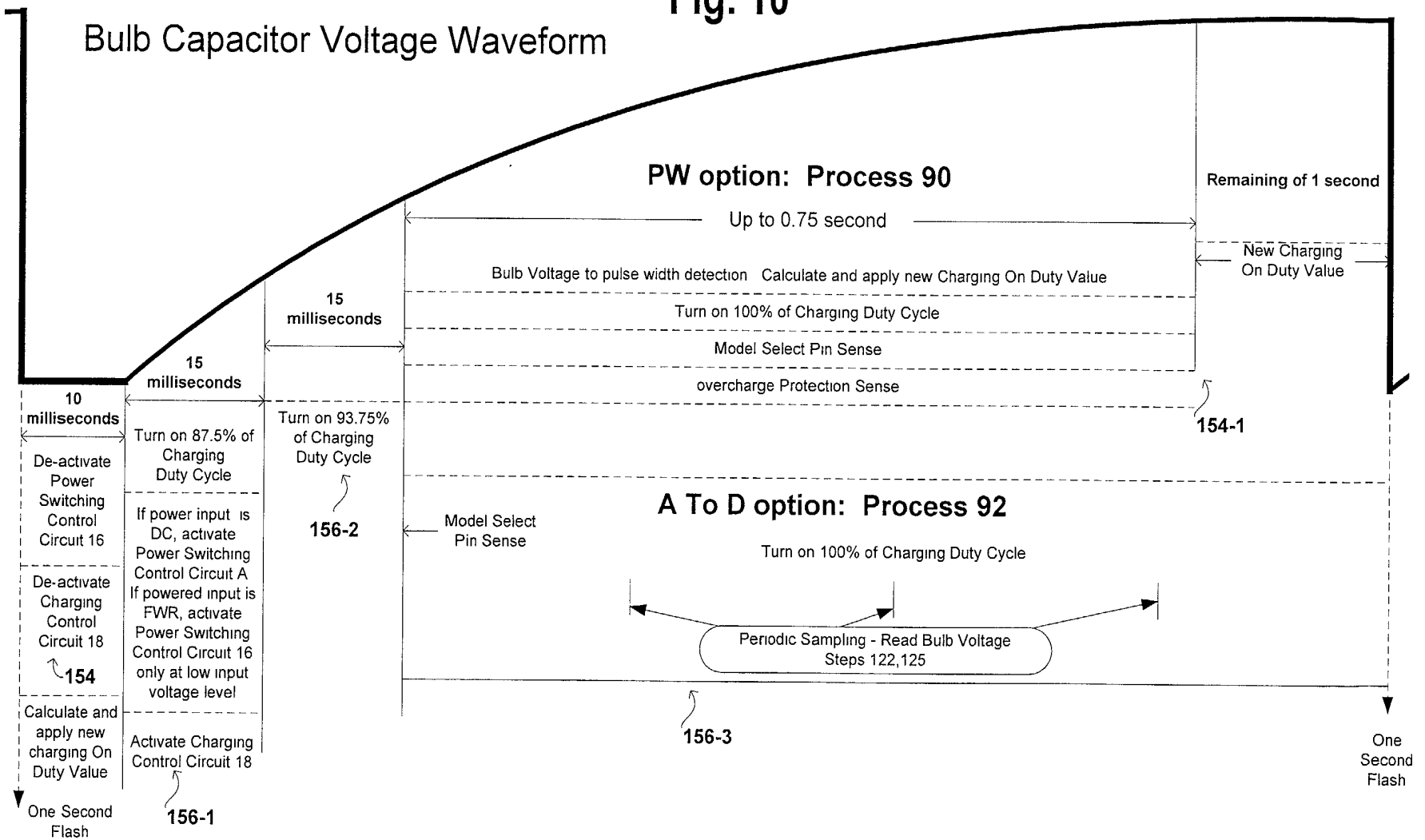

Bulb Capacitor Voltage Waveform
PW option: Process 90
Up to 0.75 second
Remaining of 1 second
New Charging On Duty Value
Bulb Voltage to pulse width detection Calculate and apply new Charging On Duty Value
Turn on 100% of Charging Duty Cycle
Model Select Pin Sense
overcharge Protection Sense
154-1
10 milliseconds
15 milliseconds
15 milliseconds
De-activate Power Switching Control Circuit 16
Turn on 87.5% of Charging Duty Cycle
Turn on 93.75% of Charging Duty Cycle
156-2
A To D option: Process 92
Model Select Pin Sense
Turn on 100% of Charging Duty Cycle
De-activate Charging Control Circuit 18
154
If power input is DC, activate Power Switching Control Circuit A If powered input is FWR, activate Power Switching Control Circuit 16 only at low input voltage level
Periodic Sampling - Read Bulb Voltage Steps 122,125
Calculate and apply new charging On Duty Value
Activate Charging Control Circuit 18
156-1
156-3
One Second Flash
One Second Flash

FIG. 11

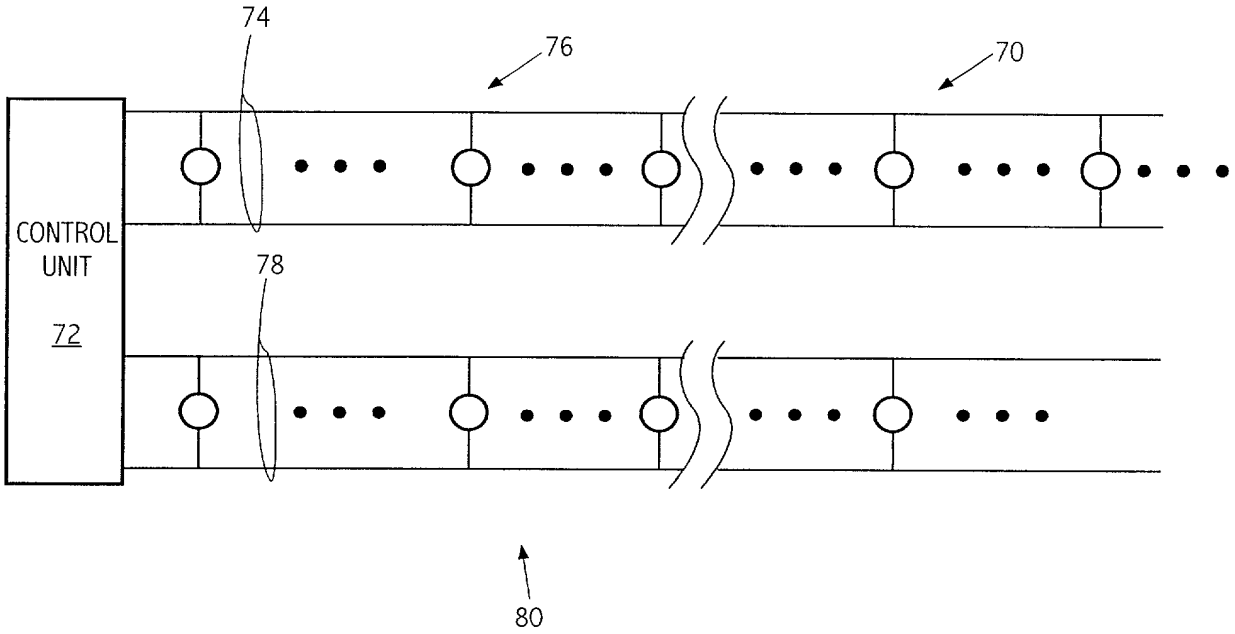


EXHIBIT 2 PAGE 13 OF 13